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ABSTRACT

The purpose of this study was to determine if the teachers trained in the site based preparation program that had obtained significant gains in self-efficacy were still expressing self-efficacy in science teaching after being in their own classrooms for one year. The 31 returned STEBI (science teaching efficacy belief instrument) surveys were analyzed for any significant changes in mean on the complete instrument and on each of the two constructs of PSTE (personal science teaching efficacy) and STOE (science teaching outcome expectancy). The mean for the entire instrument as well as for each of the two constructs remained statistically unchanged within a 95% confidence interval. The implication for teacher educators is that this specific affective dimension can be significantly enhanced and that increases can be maintained over time. The site based program can provide the four factors Bandura identified as sources of information used to determine self-efficacy. The lasting impact of the site based teacher preparation program on science teaching self-efficacy beliefs throughout the first year of teaching provides support for connecting communities of classroom teachers providing authentic experiences in site based locations with confident classroom teachers for the future. (Contains 11 references.) (Author/CCM)

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Science Teaching Self-Efficacy of First Year Elementary Teachers Trained in a Site Based Program

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Abstract

The purpose of the study was to determine if the teachers trained in the site based preparation program that had obtained significant gains in self-efficacy were still expressing self-efficacy in science teaching after being in their own classrooms for one year. The 31 returned STEBI (science teaching efficacy belief instrument) surveys were analyzed for any significant changes in mean on the complete instrument and on each of the two constructs of PSTE (personal science teaching efficacy) and STOE (science teaching outcome expectancy). The mean for the entire instrument as well as for each of the two constructs remained statistically unchanged within a 95% confidence interval. The implication for teacher educators is that this specific affective dimension can be significantly enhanced and that increases can be maintained over time. The site based program can provide the four factors Bandura identified as sources of information used to determine self-efficacy. The lasting impact of the site based teacher preparation program on science teaching self-efficacy beliefs throughout the first year of teaching provides support for connecting communities of classroom teachers providing authentic experiences in site based locations with confident classroom teachers for the future.

Science Teaching Self-Efficacy of First Year Elementary Teachers Trained in a Site Based Program

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Current reform in science education has focused on the need for improvement of preservice teacher training. The National Science Education Standards (1996) includes a chapter titled "Standards for Professional Development for Teachers of Science" that emphasizes the need to prepare future science teachers who are capable of carrying out the extensive reform guidelines. In fact, "science education of preservice elementary school teachers is seen as a critical component in the systemic approach necessary to make real and lasting change a classroom reality" (Raizen, 1994, p. 7).

Recent investigations in preservice elementary teacher preparation have studied teachers' sense of self-efficacy (Ramey-Gassert and Shroyer, 1992; Proctor, 1994). Following extensive work by Gibson and Dembro (1984) and Ashton (1984) on teacher efficacy and its impact on classroom behaviors, Enochs and Riggs (1990) developed the Science Teaching Efficacy Belief Instrument (STEBI) to measure the preservice teachers' self-efficacy beliefs. As a situation specific construct (Bandura, 1977), self-efficacy

studies have been conducted to investigate the factors that impact the preservice teachers' belief system and their sense of confidence as it relates to their ability to become successful science teachers (Proctor, 1994; Tosun, 1994; Watters and Ginn, 1995).

In an effort to assess the effectiveness of the site based teacher education program on science teaching self-efficacy, this study surveyed the first year teachers who had participated in a site based teacher education program in the Fall of 1997. The science teaching self-efficacy beliefs of this same group of teachers had been analyzed in a previous descriptive study that identified factors in the site based experiences that affected preservice elementary teachers' self-efficacy. For that study, the sample consisted of the entire population of undergraduate elementary preservice teachers in the site based teacher education program during the fall semester of 1997 at a large south central urban university. The 131 paired, pretest posttests of the entire STEBI-B and the two constructs of science teaching outcome expectancy (STOE) and personal science teaching efficacy (PSTE) were analyzed for significance in mean score gains. Results of the paired t test yielded a t value of 11.52 which was significant at $p<.001$. Statistically significant mean score gains for both constructs were also noted. The personal science teaching self-efficacy (PSTE) mean score gains yielded a t value of 10.67 which was significant at $p<.001$. The science teaching outcome expectancy (STOE) mean score gains yielded a t value of 8.56 which was significant at $p<.001$. These quantitative results were supported by interviews and by written comments on questionnaires that determined ratings for the extent of impact on self-efficacy from

site based experiences. Results of that study indicated that the experiences of the site based preservice education program had produced a significant positive impact on the preservice teachers' self-efficacy.

Theoretical Framework of the Self-Efficacy Construct

In contrast to the traditional teacher preparation model based at the university, the teacher preparation model that incorporates the use of professional development sites has the opportunity to provide experiences that Bandura identified as strategies that enhance self-efficacy. Mastery experiences through authentic performance are enhanced throughout the semester. The preservice teachers are assigned to a site based teacher for observation and are allowed to assist in small group instruction opportunities and eventually to plan and implement entire classroom science lessons. The methods classes held at the site also allowed for mastery teaching experiences as site students were included in science lessons with the university instructor and the preservice teacher. The vicarious experiences of peer reviews, critiques and modifications of lessons also expanded the preservice teachers view of themselves as competent professionals. The verbal persuasion from the site based teacher, the university coordinator and peers provided additional support for efficacy development. Finally, the psychological states and positive emotional tone that Bandura mentions came from a cohort effect at each site location.

Objectives of the Study

The objective of this study was to determine if the teachers trained in the site based preparation program that had obtained significant gains in self-efficacy were still expressing self-

efficacy in science teaching after being in their own classrooms for one year. Changes in science teaching self-efficacy during the induction year should be identified and investigated as an indication of needed interventions and support for the classroom teacher.

Design, Procedures and Findings

This one year follow up study used the same STEBI instrument delivered by mail to the 140 original participants in the teacher preparation program of the Fall of 1997. After a semester as student teachers, these teachers were now completing their first year (1998-1999) in their own classrooms. The surveys were returned by mail and the results were analyzed for comparison of means with the Fall of 1997 responses. In total, 37 surveys (26%) were returned by mail with six blank due to teaching assignments that did not include science. (7th grade math, 4th grade reading recovery, etc.) The 31 completed STEBI surveys (22%) had a mean of 89.96 which was compared with the post mean of the Fall of 1997 with a t-test for equality of means. The means for the entire instrument as well as for each of the two constructs remained statistically unchanged within a 95% confidence interval. The PSTE mean which had increased from 46.77 to 53.78, remained at 52.26 after one year. The STOE mean which had increased from 36.05 to 39.32 had remained at 38.71 after one year. Table 1 compares the original efficacy gains and the one year follow up results. The 95% confidence level was set as the criterion for determining statistical significance. We accept the null hypothesis that no significant difference between the post means and one year follow up means exists in that the difference between these means (M2-M1) was within the 95% confidence interval. The upper and lower bounds

of the interval are listed in Table 1.

Table 1.
One year follow-up of Science Teaching Self-Efficacy

Pre Mean (Sept.'97) n= 131	Post Mean (Dec. '97) n= 131	t	p	Mean (Apr.'99) n= 31	Mean Difference	95% confidence interval
STEBI-B						
82.89	93.09	11.52	<.001	89.96	-3.13	-3.26 - 6.25
PSTE						
46.77	53.78	10.67	<.001	52.26	-1.52	-1.55 - 4.39
STOE						
36.05	39.32	8.56	<.001	38.71	-.61	-1.24 - 3.46

Because the gain in self-efficacy had been very significant in the original study, these one year follow up results reinforced the importance of the site based teacher preparation program. In an effort to study the changes in self-efficacy during the teachers' first year in the classroom, this study supports the lasting contributions of the site based experiences to the induction year.

Limitations of the Study

Mailed survey returns were low at only 26% and of those, only 22% were completed and analyzed. Although survey instructions were included to return a blank instrument even if the teachers were not teaching science, casual feedback from former students indicated that they didn't return the survey because they were not

teaching science. However, maintenance of self-efficacy from the original study can not be based on the 22% that were returned. Also, induction year experiences could have played a major role in self-efficacy as confidence from authentic teaching would be strong. The self-reports of science teaching were not observed in the classroom and the actual quality and quantity of science teaching is unknown.

Significance of the Study

The implication for teacher educators is that this specific affective dimension can be significantly enhanced and can be maintained over time. The site based program can provide the four factors Bandura identified as sources of information used to determine self-efficacy. The majority of these preservice teachers started the semester with a negative attitude toward teaching science, but ended the semester with a positive view of themselves as effective science teachers in the future. Finally, these positive views as measured by the PSTE and STOE are maintained throughout their first year of teaching.

As an important component in science education reform, "science anxiety and efficacy and strategies that reduce anxiety and increase efficacy are worthy of attention in teacher education if we wish to improve the quality, quantity and success of science curriculum and instruction" (Czerniak and Chiarelott, 1990, p.55). The site based experiences credited with an increase in science teaching self efficacy seem to be worthy of discussion if one values self efficacy as a component of science education reform. The lasting impact of the site based teacher preparation program on science teaching self-efficacy beliefs throughout the first year of teaching provides support for connecting communities of

classroom teachers providing authentic experiences in site based locations with confident classroom teachers for the future.

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